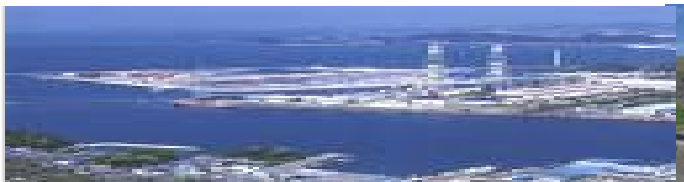



Overview

Advanced Generation RD&D Program



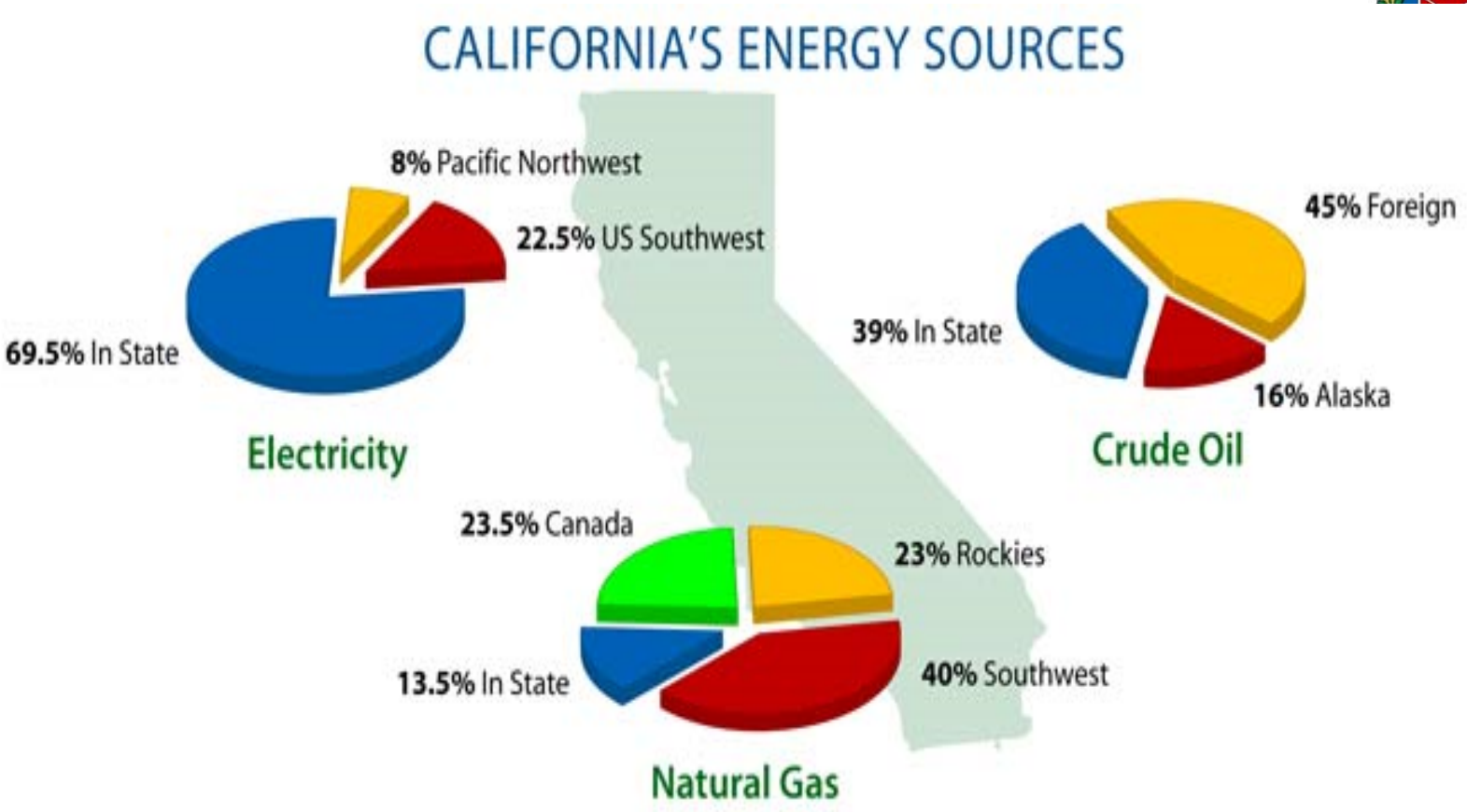





California's Energy Picture

- CA is the 8th largest economy in the world
- Growing population – over 37 million & is expected to exceed 54 million by 2040
- California's economy depends upon affordable, reliable, and environmentally sound supplies of electricity, natural gas, and transportation fuels.
- Launch pad of modern global energy industries
- Energy "resource rich"

http://energyalmanac.ca.gov/overview/energy_sources.html



Electricity (2007)
Natural Gas 45.2% Nuclear 14.8% Large Hydro 11.7% Coal* 16.6%
Renewable 11.8%
Natural Gas (2006)
In State 13.5% Canada 23.4% Rockies 27.7% Southwest 40.3%
Crude Oil (2007)
In State 39.34% Alaska 15.79% Foreign 44.88%

Advanced Generation – Policy Drivers

- Integrated Energy Policy Reports (IEPR) (2003, 2005, 2007, 2008 update)
- SB 1250
- AB 32 – Global Warming Solutions Act
- Governor's GHG Reduction Targets (Executive Order S-3-05)
- Renewables Portfolio Standard, 20% by 2010 and 33% by 2020
- Energy Action Plan (EAP) I and II
- Governor's 2003 / 2004 IEPR response and Ten Point Plan
- US 2005 Energy Policy Act

Today----All Energy Issues Are Being Considered In Context of GHG Reduction

- California became the national leader in Climate Change with the adoption of Assembly Bill 32
- Establishes a GHG emission limit for 2020 at a level equivalent to the state's 1990 emissions
- Provides the primary means to achieve the governor's GHG emission reduction targets

PIER Program

- **IOU Ratepayer-funded program launched in 1997**
- **~$80M annual funding from electricity & natural gas ratepayers**
- **Strong emphasis on collaborations**
  - Avoiding duplication,--builds on past work & ensures relevance
  - Regular coordination with IOUs, public utilities & other stakeholders
  - State Agency Partnerships
  - Market Partnerships
  - Use California Capabilities (Universities, National Laboratories, High Technology Companies)
  - Leverage/complement Federal Investments
  - California Business Entity Preference -AB 2267 (Fuentes, 2008)

PIER Program

RD&D program areas:

- Buildings End-Use Energy Efficiency (Buildings)
- Climate Change Program
- Energy Innovations Small Grant Program
- Energy-Related Environmental Research
- Energy Systems Integration
- **Environmentally-Preferred Advanced Generation (Advanced Generation Research)**
- Industrial/Agricultural/Water End-Use Energy Efficiency
- Renewable Energy Technologies
- Transportation Research

Support SB 1250 Goals for PIER RD&D Solution- Focused

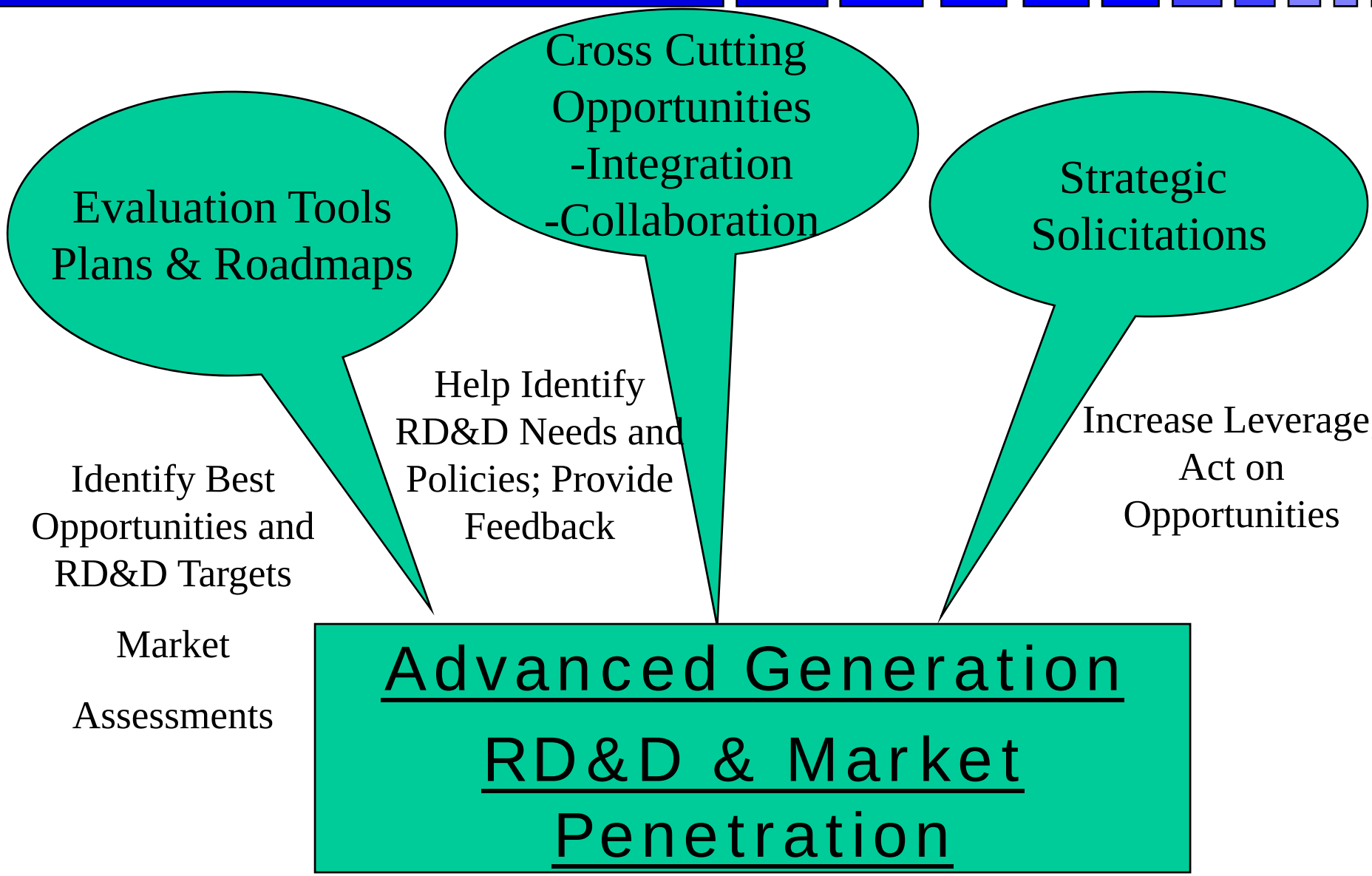
General Goal

- "Develop and help bring to market, energy technologies that provide increased environmental benefits, greater system reliability, and lower system costs"

Specific Goals

- Develop and help bring to market
  - "Advanced transportation technologies that reduce air pollution and greenhouse gas emissions beyond applicable standards, and that benefit electricity and natural gas ratepayers.
  - "Increased energy efficiency in buildings, appliances, lighting, and other applications beyond applicable standards, and that benefit electric utility customers.
  - "**Advanced electricity generation technologies** that exceed applicable standards to increase reductions in greenhouse gas emissions from electricity generation, and that benefit electric utility customers.
  - "**Advanced electricity technologies** that reduce or eliminate consumption of water or other finite resources, increase use of renewable energy resources, or improve transmission or distribution of electricity generated from renewable energy resources."

General Approach & Strategic View



Strategic Solutions – Evaluation Tools

- Roadmap
  - ✓ Draft EPAG roadmap
  - ✓ Redefine advanced generation RD&D Program
  - ✓ Complete the roadmap ASAP

- Strategic Analysis
  - Strategic value analysis & Market assessment of CHP, CCHP
  - Siting Assessment (in process)
  - Geographic Information System (GIS) for site assessment
  - Power flow modeling
  - Microgrid Potential

Strategic Solutions via Solicitations

RD&D Focus – broad areas

- Distributed Generation
  - ✓ RD&D advancements in prime mover (microturbines, gas turbines, fuel cells, low NOx technologies)
  - ✓ Meet or exceed California's most stringent environmental performance & requirements
  - ✓ Integration with grid & distribution system
- CHP/CCHP in the Loading Order (EAP)
  - Market connectedness & deployment
  - Update market assessment
  - RD&D advancements –
    - Reducing costs
    - Simplify CHP system operation: Packaged system development, better heating and cooling system
    - Apply Standardized Performance Testing and Reporting Protocols

Strategic Solutions via Cross Cutting

RD&D Focus – broad areas

- Integration with renewables, transportation & demand response
  - ✓ Inter-sectoral applications – power & transportation applications
  - ✓ Integration with Renewables – biopower CHP & CCHP, renewable heating, cooling, power (see RESCO solicitation)
  - ✓ Demand response
  - ✓ Smart grid
  - ✓ Maximize heat utilization, waste heat recovery

- Advanced generation RD&D– supporting SB 1250 & IEPR
  - – Reduce Greenhouse Gas emissions & minimize pollutant formation
  - – Aeroderivatives, CRGT and other advanced options
  - – Consider repowering options -upgrading efficiencies
  - – Encourage the use of alternative fuels –biomass, biogas, landfill gas, producer gas

Focus of this Solicitation – CHP & CCHP

CHP is of such unique value in meeting loading order efficiency and new generation objectives that CHP deserves its own place in the loading order.

CHP benefits to California include:

- *reduced energy costs*
- *more efficient fuel use*
- *fewer environmental impacts*
- *improved reliability and power quality*
- *locations near load centers*
- *support of utility transmission and distribution systems*

California has more than 9,000 MW of CHP *... With statewide generation capacity at ~60,000 MW, CHP is a key component of generation delivered to the grid. CHP represents approximately 17% of the state's generation and is often key to preserving grid reliability.*

- 2005 IEPR, p. 76-78, 2007 IEPR & 2008 IEPR Update

Focus of this Solicitation – CHP & CCHP

- ***Providing a portfolio standard with steadily increasing requirements for combined heat and power plant generation.***

- AB 1613 directs the CPUC to require the IOUs to establish tariffs and to require that electrical corporations purchase excess electricity from CHP systems (20 MW and under) that meet the efficiency standards adopted by the Energy Commission. This is a good first step but does not establish a portfolio standard that will include both large and small CHP.
- The California Air Resources Board's (ARB) Climate Change Draft Scoping Plan estimates that CHP will substantially contribute to reducing greenhouse gas emissions.

2007 IEPR & 2008 IEPR Update

Some Barriers to CHP & CCHP Implementation

- **Efficiency – fuel use efficiency, and system electrical and thermal utilization efficiency**
- **CARB's proposed 2007 emissions standards for distributed generation and CHP systems**
- **High costs – capital, installation, and O&M**
- **Reliability, availability, maintainability, and durability (RAMD)**
- **Customer-specific control**
- **Interconnection cost and complexity**
- **Loss of Self Generation incentives**
- ***Smart grid integration***

This Combined Cooling, Heating and Power (CCHP) Competitive Solicitation

Funding: $3.8 Million

We anticipate 3-5 projects will be selected with the following attributes (but not limited to:

- High thermodynamic efficiency (1st and 2nd Law)
- Systems clearly satisfy CARB 2007 emission requirements
- Performance testing and reporting according to ASERTTI Protocols
- Thermal load following capability
- Smart Grid Ready
- Provide premium power quality
- Field Demonstration of complete system preferred
- Vendor of HVAC equipment, boilers, or process heaters as team member
- Fuel flexibility – low and medium BTU gas such as landfill gas, biogas, producer gas